INTRODUCTION:
- Re-vitalized National Center for Atmospheric Research (NCAR) thermospheric general circulation model for Venus (VTGCM);
- Lowered the bottom boundary (from ~95 km to ~80 km) to insure all dynamical influences contributing to the O3 nightglow layer can be captured;
- Applied new Near-IR heating rates (Roldan et al., 2000);
- Analyze solar cycle variation;
- Starting sensitivity tests with the eddy diffusion coefficient and its impact on the airglow layer height;
- Use observations from Pioneer Venus Orbiter (PVO) and Venus Express (VE) for measurements on NO, O, and H airglows and interpret these global tracers of the thermospheric circulation with the VTGCM.
- Determine the dynamical processes that link the Venus middle and upper atmospheres through general circulation modeling of the thermosphere.

VENUS WINDS:
Schubert, G., et al., 2007

VENUS UPPER ATMOSPHERE WINDS TRACED BY NIGHT AIRGLOW DISTRIBUTIONS:
NCAR VTGCM SIMULATIONS
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INTRODUCTION:
- VENUS WINDS:

VARIABILITY OF OBSERVED AIRGLOW:
- The Variability of the UV NO airglow shows a similar pattern to the airglow observed for IR O2 airglow on the nightside.

RESULTS:
- VEX (smin)
  Neutral Temperature (Deg K) at Equator 1 = 223 K
- PVO (smmax)
  Neutral Temperature (Deg K) at Equator 1 = 223 K

Showing similarity of pattern to the airglow observed for IR O2 vertical intensity distribution.

VENUS UPPER ATMOSPHERE WINDS TRACED BY NIGHT AIRGLOW DISTRIBUTIONS:
- Pioneer Venus Orbiter (1979-1992)
  - F10.7 = 200 (in situ at start and 130 (entry at end)
  - QUV5 (airglow, neutral density and T structure)
  - ONMS (neutral density and T structure)
  - OET (electron density and T)
  - RPA (ion T and density)
- Venus Express (June 2006 to date)
  - F10.7 = 70-90 (primary mission)
  - SPICAV (airglow, neutral density and T structure)
  - VIM (radio occultation, T structure, electron density profiles)
  - VIRTIS (O2 airglow, T structure, inferred winds)
  - VMC (visible and IR camera, O2 airglow)

Conclusion and Future work:
- Upgraded VTGCM code is operational for 4-major and 1-minor species plus several photochemical on species.
- Model simulations using the Viti Co. are completed.
- Comparisons to PVO and VE datasets are starting.
- O2 IR nightglow calculations are available for new comparisons to VEX datasets (when available).
- Now capturing entire airglow layer (~90 km to 110 K).
- New Near IR heating rates (especially 4.3 mK/min heating) provide low-altitude hot spot which is contributing to the nightside temperature.
- Nightside V.E.R.  smin = 1.11x1011 at 106 km smax = 2.61x1010 at 108 km
- Nightside Integrated Intensity  smin = 52 MR smax = 87 MR
- Nightside [O]:  smin = 2.62x1010 at 108 km smax = 3.78x1010 at 109 km
- Airglow is located at midnight due to the symmetric circulation (SS-AS).
- Preliminary sensitivity tests need to be completed to show the variability of the night in airglow layer.
- Gravity wave breaking formulations will be soon incorporated into the VTGCM: (a) to provide self-consistent RSZ winds and needed momentum drag, and (b) to produce unique circulation patterns giving rise to variable O2 and NO nightglow intensity distributions.

REFERENCES: